ENERGY FACILITY SITE EVALUATION COUNCIL

In the Matter of Application No. 96-1, OLYMPIC PIPE LINE COMPANY CROSS CASCADE PIPELINE PROJECT.	NO. PREFILED TESTIMONY OF : DR. JAMES WESLEY MILLER ISSUES: COMPARATIVE RISK, SPILL ANALYSIS, PIPELINE TECHNOLOGY, MITIGATION, DECOMMISSIONING SPONSOR: COUNSEL FOR THE ENVIRONMENT

Q. Please state your name and employment position.

A. J. Wesley Miller, Ph.D., Senior Engineer of Acceleron Science Corporation

Q. What is your educational and employment background?

A. A Curriculum Vitae is attached as Ex. JWM-2 that summarizes my educational and employment background, with emphasis on recent experience. In brief, I attended the William Penn Charter School in Philadelphia, the U S Coast Guard Academy in New London, CT, where I received a commission in the U.S. Coast Guard and a B.S. in Engineering, and Harvard University in Cambridge, MA, where I received both an S.M. and a Ph.D. in Applied Physics and Engineering. In my work I have performed research for Unilever Ltd. in London, materials research for Argonne National Laboratory and Oak Ridge National Laboratory, risk assessment and engineering consulting with Science Applications International Corporation in McLean, VA. I have also been Technical Program Manager with the Oceanographic Institute of Washington in Seattle WA; Vice President of Operations and Marketing with C R Cushing & Co., New York

NY; Vice President of Operations, S & D Engineering of East Brunswick NJ; technical staff for SRS and US Space Boosters at Vandenberg AFB; Program Manager for Northrop Electronics Division, Hawthorne CA; and technical staff for Advanced Technologies, Inc. in El Segundo CA. I was Vice President of NDE Environmental Corporation from 1981 through 1989, and managed pipeline testing operations. I founded the company IIII Inspections & Investigations in 1979, and performed most of my professional work under that name until late 1996, when I became the senior engineer for Acceleron Science Corporation.

Q. What topics is your direct testimony intended to cover?

A. My testimony is intended to cover the following topics:

First, I will explain the type of services my company provides.

Second, I will explain the types of projects I have worked on concerning petroleum pipelines and marine transportation of petroleum product.

Third, I will review the comparative risks associated with the transportation of petroleum products by pipeline, barge and tanker truck.

Fourth, I will critique Olympic Pipeline Company's (Olympic) risk analysis for the proposed Cross Cascade Pipeline.

Fifth, I will comment on portions of the application that concern the design and construction of the proposed pipeline.

Sixth, I will propose additional mitigation measures that should be required if the proposed pipeline is built.

Q. Could you explain the type of business your company conducts?

A. Acceleron Science provides environmental engineering services, primarily related to pipelines and tankfarms used for petroleum, including crude, products and petrochemicals. Pipelines include transmission, and local service lines such as are used at tankfarms and terminals. Tankfarms may include those used for petroleum pipelines, bulk delivery, airport or military base fuels, and chemical plants. Our work on tanks includes all types and shapes of tanks, both aboveground and underground. We provide hydrostatic testing of pipeline integrity, pipe locating, leak pinpointing, precision tank testing, and nondestructive testing services. Most of our recent work is analytical, including environmental planning and risk assessment for proposed projects, and investigation of accidents such as ruptures and leaks, fires and explosions.

Q. In general, how did you develop the testimony you are presenting to the Council?

A. This testimony is based primarily on research performed to project the risk of operating the proposed Cross Cascade Pipe Line, as set forth in Olympic Pipeline Co.'s (Olympic) Application to the Energy Facility Site Evaluation Council (EFSEC). My testimony also includes evaluating the risks of delivering the "project" oil by present or "status quo" transportation modes, primarily barge and tank trucks. I have further evaluated the risks of delivering the “project” oil by an alternative transportation mode which would include a new expanded segment between Renton and Portland on the existing north-south pipeline. Risk analysis is performed by analysis of historical records of relevant accidents, their frequency and consequences, and applying the findings to projections of the likely risks of the proposed project. Exposure to risk is usually measured in terms of time (years of service), quantities of product delivered, and distances transported. We reviewed the Dames & Moore Cross Cascade Pipeline Project Product Spill Analysis dated February 28, 1997. We understand that the Product Spills Analysis has been incorporated by Olympic into its Application. We have also reviewed certain portions of the recent Draft Environmental Impact Statement for Cross Cascade Pipeline that was issued by EFSEC.

Q. What types of projects have you worked on concerning petroleum product pipelines and marine transportation of petroleum products?

A. The projects I've worked on concerning petroleum product pipelines include hydrostatic testing for pipeline integrity; line locating; precision leak pinpointing using a variety of techniques; development of preventive maintenance programs; spill prevention, control and countermeasures; ultrasonic testing; audit of radiographic examinations of welds; accident investigation; audit of pipeline construction and testing; risk assessment for proposed projects; feasibility studies for pipeline testing; and others. I've also worked on many aspects of marine transportation, primarily related to safety: simulation of piloted controllability of ships; casualty risk assessment for LNG transportation and tankvessels; contractual stipulations for petroleum transportation by tank vessels; safety and environmental performance during petroleum cargo transfers from tank vessels; safe navigation, especially related to improved aids-to-navigation for supertankers in harbor approaches, and accuracy of visual navigation using ranges; safe maneuvering using tugs; risk analysis and risk management for vessels in restricted waterways.

Q. In your opinion does the proposed Cross Cascade Pipeline present less risk to the environment in Washington State than the existing petroleum product transportation system?

A. No. It may actually present a greater risk to the environment than the current system even assuming that ocean and river barging will increase as predicted by Olympic. We have shown that the tank truck risks are not much different for any alternative scenario since the final deliveries are always by truck, to destination cities that are some distance from any of the likely origination terminals, Seattle, Kittitas and Pasco. Although possible barge transportation reductions might reduce certain petroleum spill risk, the possible reduction would be smaller than the increase in pipeline risk, and there can be no assurance that barges may not still be needed for oil deliveries.

Q. How do you define risk for your analysis?

A. Risk is the valuation of accident potential (likely frequency) and severity of potential consequences (quantities spilled, likelihood of damage by fire or explosion, environmental impacts to humans, other animals and plants). Both the likely frequency and consequences must be considered together. Risk cannot be properly valued without due consideration of both. Although we may simplify valuation of risk by a likely overall consequence, such as the probable total amount spilled during a project, the valuation of risk should always include due consideration of the (probability distribution) for spill frequency and spill sizes; probable spill locations and likely impacts to humans, property, animals, plants, and habitat; likelihood of ultimate consequences such as vapor transport, fires, and explosions and their impacts; and uncertainties in the projections. To summarize, risk is often defined simply as the combined value of the probability or frequency of a hazardous event or accident, and the ultimate consequences of that event. However, project risk cannot be properly evaluated or compared without a complete understanding of the likely probability distribution, scenarios, uncertainties, and ultimate consequences.

Q. How did Olympic define risk for its analysis?

A. Olympic Pipe Line Company endorsed the analysis by Dames & Moore, who defined risk as "the probability of product spill during transmission." Product Spills Analysis, page 1. They further stated that the probability would be expressed per year. The likely or probable consequences of any spill were omitted from the definition. This is a serious error in judgment, and results in a flawed presentation of the concept of risk for this project. With this type of flaw, one could conclude that the risk of a nuclear holocaust is equivalent to that of a slip and fall.

Q. Why is it important to include size and consequences of spills in the definition of risk?

A. Risk is by definition the chance of specific loss, so that both the probability (or expected frequency) and the likely consequence must be specified or understood. Risks may only be compared when the consequences are valued similarly. For example, we cannot compare financial risks in U.S. dollars to those in Pounds Sterling without knowing the exchange rate. In my entire experience performing risk assessments, from about 1976 to the present time, the concept of risk has always included consideration of the probability (likely frequency) and consequences of an accident. I have reviewed, and performed, risk assessments for nuclear reactors; coal-fired generating stations; vessel casualties for transporting oil, LNG; ship collisions with bridges; accidental ignition of nuclear warheads; multiple bursts of nuclear bombs; missile launch mishaps; spills during ship transfer operations; petrochemical plant operation, vapor transport, and possible accidents; ship collisions and groundings in restricted waters, harbor approaches, deep water ports; offshore petroleum production; and others. During this entire period I have never seen, heard of, or participated in any such review, analysis or assessment that did not include the probable consequences as part of the defined risk. As mentioned before, we cannot compare the occurrence of a nuclear holocaust and a slip and fall. We must first carefully evaluate both the frequency and likely consequences of each event in similar terms, prior to comparing the risks in these same terms.

Q. What does Olympic estimate will be the frequency of spills on the proposed pipeline?

A. Olympic estimates in the Dames & Moore Product Spills Analysis that the spill rates (frequency) will be as shown in Table 1-3 (page 5) of their report. Their estimates are only provided for the first twenty years of operation, while no commitment to conclude the project at twenty years has been provided. Summing the projected failure rates, we find they expect 1.722

pipeline failures in the 20-year period. However, the Product Spill Analysis discounts age dependence on the next page, asserting that Olympic's new technology will prevent increase in accident rates with age. Based on this assertion, Olympic predicts the pipeline failure rate would be only 0.93 spills in the 20-year period.

The Draft Environmental Impact Statement (DEIS) issued by EFSEC for this project estimates even lower spill rates at page 3-337 and 3-338. The lower spill rates are justified only by statements that there will be modern protective measures, state-of-the-art pipelines, new inspection and maintenance techniques, etc. Although one example of computation is shown in Appendix A, no basis is provided for the assumed total leak rate of 1.0×10^{-3} spills/mile/year, that is set forth in Appendix A. Also, such numbers are inconsistent with the work of John R. Mastandrea whom Olympic and the DEIS appear to rely upon. Mr. Mastendrea derives 1.3×10^{-3} for spills greater than 2,100 gallons (50 bbls), and a correction factor of about 4.5 to this, to include spills less than 2,100 gallons. This yields a total spill frequency of 5.85×10^{-3} spills/year/mile. Ex. JWM-3 at pp. 237 and 245. Further, the authors have misquoted Mastandrea in defining "leaks" as less than 50 bbls volume. DEIS at p. 3-338. Mastandrea's definition of "leak type" spills are those that occur as a slow escape of petroleum, and are not limited to small spills of up to 50 bbls. Ex. JWM-3 at p.238. The DEIS analysis and Olympic's analysis misreports and misuses the Mastandrea results to arrive at low spill frequencies, but does not apply Mastandrea's results or methods to derive estimates of the spill volumes.

Q. What do you estimate will be the frequency of spills on the proposed pipeline?

A. We have used a "Preferred Risk Estimate" and an "Olympic Best Risk Estimate," in our report which is attached as Ex. JWM-1. The "Preferred" is the derived base values of spill frequency per year per pipeline mile, and spilled volume per spill, that we believe are the most relevant and statistically significant. The "Olympic Best" values represent data more favorable to the proposed pipeline that is not as statistically valid as the "preferred" data because it is based only on Washington State pipeline spill data rather than national pipeline spill data. Ex. JWM-1 at p.1-5.

For "Preferred Risks," the Cross Cascade Pipeline will suffer about 11.1 spills of "average" spill size 63,000 gallons, for a total expected discharge of about 702,000 gallons (+/- 325,000 gallons at the 95% confidence limit), in a fifty-year project lifetime. In other words, the highest expectation is that Cross Cascade Pipe Line will have about 11 spills, and discharge about 700,000 gallons, and that within 95% statistical confidence, the total amount spilled will be between 377,000 and 1,027,000 gallons, over the 50-year period. Our Table 1-4 at page 1-8 of Ex. JWM-1 shows these values. One of these spills would most probably result in a fire or explosion of the spilled product. Ex. JWM-1 at p. 2-7. On page 2-8 of Ex. JWM-1, our Figure 2-4 shows the spill and fire frequency by product spilled.

For "Olympic Best Risks," over their projected 20-year period only, we should expect about 1.4 spills of "average" size 35,000 gallons, for a total expected discharge of 49,000 gallons. These results may be seen in our Table 2-6 on page 2-25 of Ex. JWM-1. Projecting over the more likely 50-year lifetime of most pipelines, however, we expect about 9.4 spills of "average" size 35,000 gallons, or about 325,000 gallons total. Our Table 1-5 on page 2-24 of Ex. JWM-1 shows these values for the 50-year lifetime. One of these nine or ten spills would probably result in fire or explosion.

Q. Why is your estimation different than Olympic's?

A. First, we do not believe that the Cross Cascade Pipe Line will be limited to a twenty-year life. It is common that pipeline projects last fifty years. Therefore, in the absence of a specific commitment to terminating the project at twenty years, we must assume the 50-year lifetime. Second, we cannot assume that spill frequency will not decrease with pipeline age, as Dames & Moore conjecture and assert on page 6 of the Product Spills Analysis. The pipeline accident database maintained by Office of Pipeline Safety includes many modern pipelines of the type proposed by Olympic Pipe Line. We have carefully analyzed the database for potential (hypothetical) decreasing time trends of accident frequency. Although some graphs seem to suggest such time dependence, statistical validity of the mean (arithmetic average value over time) is in all cases much more statistically valid than any hypothetical trend. In fact, if we were to use the hypothetical values of such time trends, we would project values that, when considered in the light of their projected uncertainties, would be statistically meaningless. Thus, we conclude there is no reliable basis for asserting that the spill frequency for modern pipelines is less than for older ones.

Third, we have included all reported pipeline accidents from 1968 through mid-1996, so that modern data are included in the analysis. Olympic relied on data based on 1960's and 1970's accident data. We have used a much more up-to-date, modern database, reflecting pipeline accidents during the 1980's and 1990's as well as earlier. Not only is the data more up-to-date, the results are much more conclusive, since the statistical validity is improved greatly by the increased total number of accidents in the data. There were 6,934 spill incidents, having a total discharge of 306,834,864 gallons, during the entire period. The more up-to-date, modern database does not support Olympic's assertion that that the spill frequency for modern pipelines is less than for older ones.

Fourth, to more accurately apply the age and diameter correction factors developed by Mastandrea, we interpolated to individual years using quadratic approximations, as shown in our Figures 2-10, 2-11, and 2-12 which are on pages 2-18 through 2-20 of Ex. JWM-1.

Fifth, we have also used the two risk results, "Preferred" and Olympic Best," as detailed above, in order to provide the decision-maker the best possible information.

We have explicitly added the spill frequency and spilled quantity estimates for each year, over the fifty year life cycle, to provide a straightforward estimate of the total discharge for all spills to fifty years.

Q. Does Olympic's analysis include an expected total volume of product that will be spilled by the proposed pipeline?

A. No. Olympic's numerical risk analysis is limited to frequency of spills. Olympic's analysis in the Product Spill Analysis ignores the Mastandrea approach to projecting spilled volume from historical accident data. The Product Spill Analysis discusses 12 pipeline spill scenarios, all of which are in the range 9,000 to 162,100 gallon range. None of these are "worst case" spills. On page 2-32 of Ex. JWM-1, Figure 2-16 shows the average spill size for 12" - 16" pipelines is in the range 60,000 to 90,000 gallons. On the same page of Ex. JWM-1, Figure 2-15 shows that maximum spill sizes for 12" to 16' pipelines are mostly in the range 100,000 to 800,000 gallons, with outliers above 1,600,000 gallons.

Q. Does your analysis include expected total spill volumes?

A. Yes. For the sake of comparing the alternative transportation modes, we created three scenarios. Scenario A, at page 1-2 of Ex. JWM-1, represents the proposed system that would rely on a portion of the existing north-south pipeline, the Cross Cascade Pipeline and tanker trucks. Scenario B, at page 1-3 of Ex. JWM-1, represents the current system that uses the existing north-south pipeline, ocean barges, Columbia River barges and tanker trucks. Scenario C, at page 1-4 of the Ex. JWM-1, represents an alternative system that relies on a portion of the existing north-south pipeline, a new north-south pipeline segment from Renton to Portland and tanker trucks. Because the existing north-south system presents a static risk, we did not include any risks associated with that system. That does not mean that the existing system does not pose risks to the State's environment, but merely that those risks are static for the purposes of making decisions on this project.

Accordingly, the product spill amounts that are predicted for Scenario A, the proposed pipeline, include only spills associated with the new pipeline and the tanker trucks that deliver the product to central and eastern Washington.

The product spill amounts that are predicted for Scenario B, the current system or status quo, include only spills associated with ocean barges, Columbia River barges and tanker trucks delivering product to central and eastern Washington.

The product spill amounts that are predicted by Scenario C, the alternative system, include only spill associated with the new pipeline segment, Columbia River barges and tanker trucks delivering product to central and eastern Washington.

With that said, the total volume I have predicted that may be spilled by Scenario A, the proposed pipeline system, over a fifty year operating period is 1,016,661 gallons. The total volume I have predicted that may be spilled by Scenario B, the existing system, over the same fifty year period is 565,114 gallons. The total volume I have predicted that may be spilled by Scenario C, the alternative system, over the same fifty year period is 906,573 gallons. Ex. JWM-1 at p.1-8.

As you can see by reviewing Table 1-4 at page 1-8 of Ex. JWM-1, these numbers are not intended to be exact amounts. The numbers represent a range and thus should only be used as a basis for comparing the different scenarios.

Q. What does Olympic estimate will be the frequency of spills by barges in Washington if the proposed pipeline is not built?

A. Olympic estimates the annual spill frequency of barge spills will increase from 0.108 at the beginning of the project, to about 0.156 per year at the twentieth year. Product Spill Analysis at p. 11.

Q. What do you estimate will be the frequency of spills by barges in Washington if the proposed pipeline is not built?

A. For the sake of comparison we assumed, as did Olympic, that all of the product Olympic expects to move on its proposed pipeline will be supplied by the Puget Sound refineries whether or not the proposed pipeline is built. This assumption biases the total spill volumes for barges in Olympic's favor because it is unlikely that the Puget Sound refineries will supply all of the increased demand in central and eastern Washington. If the Montana refineries increase their supplies into central and eastern Washington, both Olympic's and my predicted spill volumes for barges will likely be too high.

With that said I have estimated the frequency of spills by barges in Washington if the proposed pipeline is not built to be 4.79 per year at the beginning of the project, to about 8.225 per year from year 20 to year 50 of the project. Ex. JWM-1 at p. 3-18. We include spills during transit of outer coastal barges from the refineries to Portland, as well as river barges from Portland to Pasco.

Q. Why is your number different than Olympic's?

A. Olympic's entire barge spill analysis is based on a study that was performed to look at coastal spills, primarily crude oil spills, and that utilized data from back in the 1970's. These data did not include small spills, which are in recent years reported diligently in the marine community. No effort was made to look at more recent data, nor to focus on the more important parameter of risk, the likely volumes of oil that are spilled. Since the spills of concern to Cohen and Aylesworth (the primary study referenced in the Dames & Moore Product Spill Analysis) were in the thousands of barrels, and the spills of concern in the 1990's data that we have used are in the hundreds of gallons, it would be a mistake to compare frequencies based on this data.

Q. What does Olympic estimate will be the frequency of spills by tanker truck in Washington if the proposed pipeline is not built?

A. Olympic estimates in the Product Spill Report at page 10, that there would be about 3.7 spills per year at the beginning of the "project," and about 5.9 spills per year at the twentieth year.

Q. What did you estimate will be the frequency of spills by tanker truck in Washington if the proposed pipeline is not built?

A. We estimate that there would be about 1.74 tank truck spills per year at the beginning of the "project," and about 2.98 spills per year from the twentieth to the fiftieth year. Ex. JWM-1 at p. 4-3.

Q. Why is your estimate different than Olympic's?

A. First, the Product Spill Analysis uses an accident rate that is apparently based on all tractor-trailer truck incidents, rather than only for incidents related to tanker trucks in petroleum cargo service. Licensed tanker trucks are specially licensed and inspected, as are their drivers. Their accident rates are much less than the average tractor-trailer truck. Second, Dames & Moore have apparently used a spill rate for all types of hazardous materials from tractor-trailer trucks, rather than considering only spills of petroleum and petroleum products. Our analysis considers only spills from trucks transporting petroleum and petroleum products. We do not include accidents involving other trucks, nor tanker trucks transporting other commodities. We include tanker truck trips from both Seattle and Pasco to destination cities in central and eastern Washington. Olympic assumed tanker truck trips from Seattle to Pasco. This is an unrealistic scenario since, if the Cross Cascade Pipeline is not built, barges are most likely to carry the products to Pasco, and tanker trucks would deliver to destination cities from Pasco.

Q. Do you agree with Olympic that the proposed Cross Cascade Pipeline would greatly reduce the need to ship fuel by tanker truck?

A. No. Section 4 of Ex. JWM-1, discuss this issue and conclude that although the proposed pipeline will likely reduce traffic over Snoqualmie Pass, and make truck trips in central Washington shorter, the proposed pipeline will also create new truck trips in eastern Washington. If Tidewater barges no longer deliver to Umatilla and Clarkston, additional trucking will have to go out of Pasco. Each alternative oil transport scenario must finally deliver the same quantities of petroleum products to the ultimate consumer. Olympic's Product Spill Analysis has ignored this fact. The ultimate consumers of central and eastern Washington are primarily in the largest cities of central and eastern Washington. We have chosen the top ten cities in population. There may be a small error in ignoring other smaller cities, but the error will be small. Oil products will be shipped to these cities in close proportion to their population. We have chosen to proportion the product cargoes accordingly, by performing a population-weighted average of the distances. On page 4-2 of Ex. JWM-1, Table 4-2 shows these cities, their distances from Kittitas, Seattle and Pasco, and the computed (weighted) average distances.

We have set forth three alternative oil transport scenarios. They are shown individually in Ex. JWM-1 in Figures 1-1, 1-2, 1-3, and schematically in Figure 1-4. Petroleum products must ultimately be delivered to their destination by tank trucks, in all scenarios. Scenario A includes the proposed new Cross Cascade Pipeline. The required tanker truck deliveries to destination cities in central Washington from the Kittitas terminal average a distance of 43.8 miles as is shown in Table 4-2 of Ex. JWM-1. The required tanker truck deliveries in eastern Washington from Pasco average a distance of 93.8 miles as is shown in Table 4-2.

Scenario B projects continuation of the status quo, with delivery of "project" oil to central and eastern Washington in the same stages and volumes as proposed for the pipeline project. This allows consistency in comparison of the transportation alternatives, and the computed risks. Existing Olympic pipelines deliver "project" oil to Seattle and Portland, while outer coast barges carry more oil from the refineries to Portland. Columbia River barges carry the Portland "project" oil to Pasco. Tanker trucks must deliver oil to central Washington from Seattle which is an average distance of 127.9 miles as is shown in Table 4-2. The required tanker truck deliveries to eastern Washington from Pasco for Scenario B average a distance of 92.8 miles as is shown in Table 4-2.

Scenario C postulates a newly constructed segment on the north-south Olympic pipeline between Renton and Portland to increase the presently restricted capacity of that pipeline route. Outer coast barges would not then be required, but tanker trucks must still deliver from both Seattle and Pasco just as for Scenario B.

Tanker truck deliveries to central and eastern Washington destination cities (the ten largest) are projected in a consistent and proportionate manner. The closest routes are chosen in each scenario. As mentioned, average distances are population-weighted, thus weighting product delivery according to population demand. An inherent assumption is that the relative populations of the destination cities remain the same over the projected period. This is the simplest and safest assumption for purposes of projection. Volumes of product shipped by each transport segment are shown on page 1-10 of Ex. JWM-1 in Table 1-6. All oil product delivered to Kittitas or Seattle is trucked to central Washington cities, while all product delivered to Pasco is trucked to eastern Washington cities.

The end result is that the total (population-weighted average) trucking miles, and the trucking ton-miles, for the three different scenarios do not vary much. Since the ton-miles only vary by 13 percent, the tanker truck spill risk also only varies by 13 percent. To summarize, construction and use of the proposed Cross Cascade Pipe Line would then only reduce tanker truck transportation of oil products by about 13 percent. This would of course reduce the expected frequency and volumes of tanker truck spills also by 13 percent; however, added to this are expected pipeline spill frequencies whose average volume per spill is about 63,000 gallons compared to the average spill volume of about 2,500 gallons for tanker trucks.

We realize there is a Chevron Pipeline between Pasco and Spokane, and that actual trucking miles in eastern Washington are therefore likely to be lower than our analysis predicts. Since we have treated all three scenarios consistently, this discrepancy is small and unimportant for comparing the three scenarios.

Finally, although it is possible that the proposed pipeline would create new westbound traffic over Snoqualmie Pass from Kittitas to eastern King County, we have not included these routes in our truck mileage calculations for Scenario A.

Q. Did Olympic's analysis of risk include potential worst case scenario spill volumes at any particular locations?

A. No. In reading the analysis and reviewing the Spill Scenarios created by Dames & Moore, one is led to believe that there are some worst case scenarios. The spilled volumes range from 9,300 gallons to 162,100 gallons. These types of spill volumes, however, do not represent worst case scenario. Rather, they are representative of small and typical pipeline spills.

The truth of this is evident by looking at Ex. JWM-1, Figures 2-8 and 2-9. These figures are based on the Office of Pipeline Safety's entire database of pipeline petroleum product spills from 1968 to 1996. Most of the spilled volume is caused by spills in the range of 50,000 to 500,000 gallons. Extraordinary or "worst case" spills are generally larger than these. Also, since there are no regulatory oversight audits of industry-reported spill sizes, reported spill quantities are often underestimated. Thus true "worst case" spill volumes may be two or more times the reported "worst cases."

Looking briefly on pages A-28 to A-30 of the Product Spill Analysis at the "practicable worst case" spill scenario at East Hyak, where 162,100 gallons has spilled, we see that the volume is limited by assuming that line discharge from the rupture continues for only 2 hours. While it is true that the Control Center would detect the loss of pressure within minutes, it is not always the case that line shutdown occurs automatically. This would be a best case assumption. While local reports sometimes locate the rupture site quickly, this process often requires hours. Block valves must then be shut to isolate the rupture site, thus limiting the spill size. This may take further time. Weather, flooding, or communications problems can interfere with the process, and often may cause delays. Finally cleanup contractors are contacted. Response to the site may require four or more hours, especially if weather conditions are bad, or some equipment must be flown in. Effective response may be delayed for up to twelve hours from the time of rupture. The scenario assumptions made by the Product Spill Analysis are really best case assumptions. As a result, the projected spill volumes for pipeline scenarios are small to medium spills, and most do not even approach the average sizes of 75,000 to 100,000 gallons we have noted in Ex. JWM-1, Figure 2-16.

Q. Did you include potential worst case scenario spill volumes in your analysis?

A. Yes. We present an understanding of "worst case" spill volumes using several approaches. First, as we just explained, the spill frequency vs. volume distributions shown in our Figures 2-8 and 2-9 (Ex. JWM-1) show that "worst case" volumes must extend from 50,000 gallons or higher to 500,000 gallons or higher.

We also show some computed spill volume indicators for the proposed alignment of the Cross Cascade Pipeline in Table 2-7 at page 2-28 of Ex. JWM-1. These "potential" spill volumes are simply the amounts contained in the pipe from the pipeline peaks on each side of pipeline troughs (low points) along the pipeline route. We picked low points of the route because those locations are often associated with factors that cause spills, for example, mass wasting and stream scour. I have also picked the low points because those are the locations you would expect to lose the most product if the line is breached. Product on either side of the breach would be expected to discharge rapidly due to gravity. The spill amounts in Table 2-7 represent the amount of product between block valves that would discharge from the line quickly if the pipe ruptures at or near the selected low points. Much greater volumes would accrue under nonideal circumstances. These values do not represent worst case scenarios since immediate detection and shutdown are implicitly assumed in this calculation. Another built-in assumption is that valve closure is immediate, and that the valves close as they are designed to close and will not leak through. Thus a worst case spill would be greater than the amounts in Table 2-7, and might be much greater. Block valves do not always close as designed and often leak through even when they are closed. Thus the spill volumes in Table 2-7, which are in the range of 50,000 to 350,000 gallons, provide a lower threshold estimate of "worst case" or extraordinary spill volumes, and represent more typical spill sizes, as shown in Figures 2-8 and 2-9 of Ex. JWM-1.

We then examine average spill sizes, and maximum spill sizes, for spills from pipelines only in the size range 12" to 16" diameter, the range of interest for Cross Cascade Pipeline. Figure 2-16 of Ex. JWM-1, shows that the average spill size is in the range of 75,000 to 100,000 gallons. Figure 2-15 shows that maximum or "worst case" spill sizes range from 200,000 to 1,700,000 gallons, with a mean higher than 400,000 gallons. The actual worst case pipeline spill, i.e., the largest so far reported in the OPS database, is about 22,000,000 gallons.

Another excellent method for identifying potential worst case scenarios is to review NTSB reports for the really important pipeline spills over the last fifteen years, for example. Such a review is also important to show the "lessons learned" from each accident, in order to assure improving prevention and response in the future. We find that spills ranging from 200,000 up to 1,000,000 gallons are not very unusual. We further find that pump shutdown is not always so immediate as might be desired, that location of the leak or rupture often takes several hours, and that valve closure often take many more hours. We further notice that discharge from the line often continues for many days, even when valves are closed! In such cases, there is no response to plug the holes in the line itself to stop or inhibit the discharge. This method of picking "worst case" spills enables choosing from additional scenario circumstances than merely the larger spilled volumes. The utility of "worst case" scenarios is their ability to serve as criteria for prevention, emergency preparedness and training. NTSB pipeline accident investigation reports have much to teach us.

Q. Have you reviewed Olympic's spill scenarios that are set out in the Product Spill Analysis report?

A. Yes.

Q. Do you have any general comments on the spill scenarios?

A. Yes. Because Olympic chose to exclude the consequences factor from its definition of risk, the primary information they have provided the Council concerning potential environmental impact of the proposed pipeline is contained in the scenarios. As such, this information is exceedingly lacking, and misleading, in terms of the actual risks posed by the proposed pipeline. The scenarios purport to "illustrate a practicable worst case at locations in proximity to sensitive environmental resources." Page 3 of the Product Spill Analysis. The scenarios, however, are not "worst case" or even practicable worst case scenarios. They are more accurately characterized as best case scenarios, since careful reading reveals that all of the pipeline technologies and emergency procedures work exactly in each case as they are designed to work, and often better than they could work. Detection and shutdown are within minutes, for example. "OPL personnel and a response trailer are mobilized and arrive at the spill site within 1.5 hours." Page of Product Spill Analysis. The scenarios seem designed to demonstrate the best discovery and response that is possible and the least environmental damage that is possible. In real worst cases, such as those investigated by NTSB, things go wrong such as, a flood covering the valves and controls so that days are required to close one critical manual block valve. The "check" in a check valve has been found to be nonexistent! Pipeline operators are not always able to tell from control systems whether a pipeline is leaking or ruptured.

The pipeline spill volumes in the Product Spill Analysis are unrealistically small for practical worst cases; the draindown is grossly underestimated. The apparent limitations on draindown are frequently exceeded in real spill scenarios. This is why the worst case spills are in the range of 200,000 to 1,700,000 gallons, for pipelines in the 12" to 16" diameter range. Real world factors that enable large draindowns are: most large diameter block valves, especially those not subjected to regular hydrostatic tests for tightness and follow-up maintenance, leak through appreciably in practice; seals of pumps and valves admit air into the line once pressure is down, enabling siphoning of oil through the line; response to close manual block valves is often lengthy, or impeded by flooding, fire, inaccessibility, or other difficulties; ruptures often occur at low points in the line and thus the pipe drains from both sides of the rupture.

Moreover, it is difficult to fully evaluate the spill scenarios because, there is incomplete explanation as to why the specific spill locations were chosen. There is no explanation concerning how the different scenarios were designed. The scenarios do not provide adequate information concerning the risks posed by the proposed pipeline to allow decision makers to compare the project to the existing transportation system or to other alternatives.

A systems analysis could be performed to plan criteria and select sites for which spill scenarios are designed, to assure the reader and decision-makers of selective representation. Also, worst case scenarios for pipeline ruptures from 14" pipelines can readily be selected from the national OPS database.

Scenarios should be designed and developed by systems analysis of spill risks, and sensitive environments. At page the Product Spill Analysis contends that "evaluation of environmental consequences of accidental spills cannot be made with reference to a known or expected release of a specific size, location and duration. Instead, scenarios which represent "assumed" accidental spills are constructed and evaluated." Scenario design and development should follow systematically from results of several types of risk assessment. Study of case histories of relevant pipeline spills, for example, would provide much important information for this process. Accident databases are another good source. Some of the scenarios should be extreme, maximum credible events, taxing preventive and response systems, while other should be more typical. We have already pointed out that the chosen pipeline scearios do not truly represent practical worst case discharge volumes for this size pipeline, but more average releases instead. As such, the pipeline scenarios cannot then provide decision-makers adequate perspective on maximum risks, nor stress the response planning functions. Each scenario should provide critical information about the risks, prevention, and response planning.

I have designed "worst case" spill scenarios for environmental approvals, and also for SPCC plans. In several cases, these scenarios have later been used to provide spill exercises. In at least one case, the actual "worst case" occurred, and was in national newspapers. The spill scenario had also been practiced, and the response was pursued with diligence. Great emphasis and care should be placed on these scenarios.

The existing spill scenarios lack sufficient detail for identifying prevention and response measures. More systems analysis and development study of case histories is needed. Analysis is absent regarding likelihood of spills at critical low points or stress points in the pipeline route, or on the strategic placement of valves. There does not seem to have been an intensive effort to determine when, where, how, why and in what amounts spills may occur, as a prelude to developing the scenarios. Careful study of case histories and accident databases can provide much of this information and a systematic basis for scenario development. Study of the scenarios to evaluate spill response effectiveness can also lead to improved strategies for valve locations and response equipment staging.

Although the scenarios are not intended as a comprehensive outline of expected spill response, they should be a developmental tool for response planning. They must provide risk information otherwise unavailable for assessment purposes, and exemplify issues and findings of field studies and analysis. They must be realistic, providing information about problems as well as some answers to questions.

Q. What are some of the specific assumptions in the spill scenarios that you would not expect in this type of analysis?

A. Appendix B of the Product Spill Analysis sets forth some of the assumptions in the different scenarios. For short-term leaks, which are defined as a complete break in the line, the scenarios assume that there is no product leaking from the pipe after two hours. There is no basis to make such an assumption. It often takes more than two hours to reach a spill location. If there is a complete line break it is highly unlikely that such a break could be plugged in any short time frame. Moreover, it is highly unlikely that all of the product in line segments impacted by the rupture would finish draining within two hours. Pipeline ruptures often continue to leak for days. They often continue to leak even through closed block valves. Assuming a two-hour maximum duration for a major spill is highly problematic and misleading.

The short-term leak scenarios also assume that the nearest block valves will completely close within two minutes of the actual spill event. If the line segment suffers a complete breakage, the correct pump stations may be isolated and shut down within two minutes, but it is unlikely that the correct block valves will also be isolated and completely closed within two minutes. A more likely best case scenario figure would be ten minutes. Moreover, even if the block valves are closed they often leak through. Periodic hydrostatic testing of block valves, and follow-up maintenance, would reduce this problem.

Accordingly, the combination of assuming that a major rupture would not last more than two hours and would begin to be contained within two minutes has caused Olympic to drastically underestimate the amount of product that would be spilled in the short-term scenarios.

For the long-term scenarios, the leaks are assumed to occur no more than seventy-two hours. This is another highly suspect assumption for any type of analysis much less a practicable worst case scenario. Olympic cannot assure the Council that its systems can detect any size leak within seventy-two hours. In fact leaks below 1% of flow volume can go undetected for weeks or months, possibly even for years.

The long-term scenarios also assume that the correct block valves are closed within five minutes. It is highly unlikely that the correct block valves will be identified within five minutes much less closed. Small leaks can occur for significant periods of time and thus the released product may be discovered in a location that does not readily identify the source or location of the actual release.

Finally, the long-term scenarios assume that small leaks are not only detected but located and stopped within two hours. As noted above, product from small leaks is often discovered at locations distant from the pipe, and thus they are difficult to locate. Even if the product is discovered close to the pipe, the product may have traveled along the ditch under the pipe, and thus the location of the actual leak can be difficult to determine.

Accordingly, the combination of assuming a too short maximum release time and a too short response time has caused Olympic to drastically underestimate the amount of product that would be released in the long-term scenarios.

Q. Is there any thing else in Olympic's product spills analysis with which you disagree?

A. Yes, there are many problems with the Product Spill Analysis. I'll enumerate several briefly.

1. The study fails to consider serious safety and environmental risks to the public. The principal product to be shipped will undoubtedly be gasoline, a flammable and explosive commodity posing serious risks of fire and explosion wherever handled or accidentally released. These products contain some benzene, MTBE, and sometimes other toxic additives. The risks of fire, explosion, and toxic contamination of drinking water supplies have not been seriously addressed in the spills analysis.

2. The study overstates Cross Cascade Pipeline safety as "approaching zero spill probability." Stated frequencies of petroleum spills appear underestimated by about 40 percent. The manner of expressions, "that the spill probability per year along any specific 1,000 feet or

less of the pipeline approaches zero" is an exaggeration at best. Mathematically, this can only be stated as the pipeline length being considered is also reduced toward zero. It is more appropriate to express the spill frequency per mile, for the entire pipeline length, and for the planned or estimated pipeline lifetime. More importantly, risk can only be properly understood and considered when probabilities (frequencies) and consequences (spilled volumes, fires, injuries) are shown together. Thus the range of expected spill volumes, and the distribution of spill probability by expected spill volumes, should also be presented here.

3. The study inaccurately presents spill performance, risk and impacts for project lifetime. The presentation divides the pipeline spill performance into three time periods, for a total time period of only 20 years. It is not stated that the planned useful life of the pipeline system is only 20 years. In the absence of a commitment to a 20-year lifetime, it is appropriate to use the more common assumption for pipeline life, a fifty-year period. Since the pipeline life is artificially truncated at twenty years, the most significant spill probabilities (at higher age) are omitted! No total estimated spill frequency, spilled volumes, estimated property damage, or total environmental impacts, are given for the entire project.

4. The study inaccurately indicates that the Cross Cascade Pipeline Project will reduce current risks. We should not expect reduced reliance on the existing pipeline to change the spill risk for that segment of pipeline unless it is taken out of service and emptied of product. Pipeline spill risk correlates primarily with miles of pipeline, not with the quantity of oil delivered. Hence, the spill risk for the existing pipeline remains the same, even though there might be less oil throughput. Tank truck risks are not significantly different for alternative scenarios because the final deliveries are always by truck, and must include the most likely (most economic) trips and mileages from both Seattle and Pasco to Eastern Washington destinations. Possible reduction in barge transportation can reduce petroleum spill risk; this reduction cannot be assured, however, because the free market may simply redirect the ultimate destination of barge fuel deliveries.

5. Tank truck spill rates are in error. Simple arithmetic is inappropriate to small vs. large spills. Construction and operation of the CCPL is predicted to reduce annual spills of refined petroleum products by 4 to 6 spills per year. This claim is highly influenced by the relatively high estimated spill rate for tanker trucks. Table 3.1 on page 12 of the Product Spill Analysis shows that tanker trucks account for more than 95 percent of the spills that will be reduced. It is important to limit tanker truck spill risk analysis to tanker truck accidents and spills by tanker trucks transporting crude oil and petroleum products only, rather than deriving results from tractor-trailer accidents at large. Accidents and spills are less in this case because the drivers and the tank trucks are more strictly controlled by regulations. Also, one cannot compare frequencies of limited volume spills from tank trucks with potentially unlimited (and frequently immense) spills from pipelines. Simple arithmetic of this sort is not appropriate, and is very misleading to the reader.

6. Massive spills and chronic, undetected leaks are not considered. The generally accepted definition of risk is:

Risk = Probability (or expected frequency) x Consequences (spilled volumes, damage, lives lost, etc.)

The principal spill risks are due to larger spills, and chronic, undetected leaks that are also large. Environmental impacts of spills cannot be properly considered without due consideration of expected spill volumes. Large pipeline spills often range from 200,000 to 1,000,000 gallons or more, and cause serious environmental harm. These impacts are ignored. The significant risk of fires and explosions to public and environment is also ignored. Resources such as the Cross Valley Aquifer and the Yakima River Valley are exposed to the risk of significant spills for extended distances, so that the environmental risk to these resources is increased, rather than "approaching zero."

7. All available risk assessment information is apparently not used or referenced. on page the Product Spill Analysis states, "Anytime RPP is transported, there is the potential for

accidental spill of product and its release into the environment. Indeed, statistical data are available for documenting such accidental releases." The Product Spill analysis does not, however, appear to draw directly upon and integrate into its risk assessment the wide range of statistical data that it acknowledges exists. The Product Spill Analysis has no bibliography, no index of cited work, only brief, sometimes incomplete footnotes of works upon which it has relied. For example, the Product Spill Analysis states in footnote 125 on page 17 that "other EIS's and EIR's have also been used as source documents," but gives no further information. The Product Spill Analysis cites other works that it represents influenced the study's methodology, but the reference is so brief and general that the basis for methodology seems flimsy.

8. Spill cleanup procedures are inadequately addressed in the report. The public's interest in cleanup procedures is not reflected in the priorities of the Product Spill Analysis. Cleanup procedures are cited as a highlight of interest at public meetings, and yet this priority is given short shrift in this report. The likely location of spills should be the basis for planned logistics of spill cleanup; this analysis was alluded to, but not performed. Definition of required resources, training, equipment, and staging flow from the likely location analysis. Criteria for cleanup performance, time to respond with adequate equipment to stop the spill, definition of training - all of these remain to be addressed. The Oil Pollution Act of 1990 requires that facilities not only have adequate spill response plans, but have adequate plans for the threat of a spill, such as may be present during floods, storms, earthquakes.

9. Presumed reductions in spill frequency by new technology are unsupported by facts. The statements on page of the Product Spill Analysis, "However, since the age correction factor was developed based on historical data including pipelines of older technology it may not be appropriate to further correct for age beyond 20 years. Thus the expected number of spills per year is not expected to increase as the proposed pipeline ages further.", are very rash considering historical date

A fundamental principle of reliability and maintainability engineering is the "bathtub curve" of failures, which characterizes the higher failure rates of engineering systems both at the beginning of operation, and as age results in deterioration of component parts in many ways. This principle cannot be dismissed with a wave of the hand. Many new and proven technologies would need to be used, their effectiveness shown, and their immunity from this relationship demonstrated, in order to support the claim that the pipeline reliability will remain the same from 20 years on through the system lifetime.

Moreover, a significant portion of pipeline failures is caused by third parties. New technology will have little impact on these failures, especially in light of the fact that populations around the pipeline will increase over the life of the project.

10. It is essential to forecast the risk, and hence all traffic and cargo for the pipeline lifetime of about 50 years. Although forecasting growth rates beyond 20 years may have great uncertainties, it is essential to forecast and compare the risk of the project and alternatives throughout the likely lifetime of the project. Most pipeline do continue well beyond 20 years, and 50 years is generally considered the lifetime of a pipeline project.

11. Oil tanker truck accidents are not properly categorized, which results in excessive risk values. It is doubtful that spills of hazardous materials from tractor-trailer accidents constitute spills of petroleum and petroleum products from licensed tanker trucks. The latter are the appropriate class of vehicles and spills for which we must estimate the risk. We find that the rates the Product Spill Analysis computes and applies to tanker trucks are five or six times too high. Tanker trucks carrying oil and hazardous materials, and their drivers, are highly regulated at federal and state levels. We obtained spill accident data analyses directly from Department of Transportation/Research and Special Programs Administration/Office of Hazardous Materials/DHM-63, for tanker trucks only, carrying crude oil and petroleum products. These data included the number of annual spill accidents, the annual tank truck spilled volume, and the total ton-miles of crude oil and petroleum products carried, for the years 1984 through 1994. The

annual average number of spill accidents was 147.1, with an annual average of 36,022 gallons spilled, and for 29.1 billion ton-miles transported. The risk of spill accident is 5.055×10^{-9} per ton-mile per year, and 1.313×10^{-5} gallons spilled per ton-mile.

We compute from the Product Spill Analysis' value of 6.60×10^{-7} spills per tractor-trailer-mile, using its 190.5 barrels/load, at an average product 7.136 barrels/ton, a value of 2.47×10^{-8} spills/ton-mile. This rate is 4.9 times greater than the risk computed using DOT/RSPA/OHM/DHM-63 results.

12. Barge spill risks require a comprehensive treatment since barges presently transport 43 percent of the product. The brief and incomplete treatment of barge risks, by reference only, is inappropriate to the importance of these risks. It is also important to recognize that the spill size distribution for each mode will be quite different, first because of the very different physical conditions and limits present during spills from pipeline compared to barges, compared to trucks. Much needs to be known about each spill size distribution, since the predicted spill frequencies for different size distributions cannot be directly compared, or treated arithmetically.

13. Table 3-1 on page 12 of the Product Spill Analysis is a travesty of errors and misrepresentations. Alternate mode spill frequencies of different size distributions and cannot be directly compared, as in Table 3-1. This is not mathematically sound; it is erroneous. Only when much more is known about each spill size distribution can comparisons be made, and then the many unique factors for each type of spill must be considered at the same time.

Pipeline spill frequencies must also be corrected for age, in Table 3-1 of the Product Spill Analysis. No sound justification is given for assuming that the risk of modern, well-maintained pipelines, will not spill more with age. Mention is made of apparent trend in data from 1979, which is old data, while we have looked comprehensively at data up to 1996 and cannot justify such a trend statistically yet. The record is clear at this time that pipeline age is the main factor influencing future expected spills, and Mastandrea's results have not yet been superseded by more comprehensive study. The second and third time periods of this table should be corrected for pipeline age, and an additional column added to represent the remainder of the fifty-year project lifetime.

Tank truck spill frequencies are overestimated, biasing the results; pipeline life is longer, thus spilling more than represented on page of the Product Spill Analysis in Table . The bottom line of this table is further in error because the final negative numbers, apparently favorable to the proposed pipeline, represent primarily the tanker truck frequencies, which are erroneous by a large factor. We have shown that these tanker truck spill frequencies are in error by a factor of about 4.9. The Table should also be corrected to include a longer pipeline life, and the increased risks due to age during the later years. With these corrections, pipeline risks will increase dramatically due to both age and increased demand. Results for later years will not then favor the new pipeline.

Barge spill frequencies are not really greater than pipeline spills, and would be exceeded by pipeline spills in later years. According to Table on page of the Product Spill Analysis, in the first five-year period, barges would spill approximately 0.108 times per year, while the pipeline would spill 0.0466 times per year, a very small difference. The statistical uncertainty in both these numbers may in fact greatly exceed the small difference. In later periods barges are even more competitive with the proposed pipeline, in spill frequency. Also, the barge spill frequency increases only with increased throughput (trips), while the pipeline spill frequency will increase dramatically with age, beyond what is shown in Table , especially during the period from 20 to 50 years project lifetime. Pipeline spills will undoubtedly exceed barge spills during later periods, thus favoring barge transportation over the proposed pipeline.

Q. Do you have any specific critiques of the first spill scenario?

A. Yes. The purpose of the scenario is stated at page A-6 of the Product Spill Analysis as presenting "the potential issues associated with a spill over a sole source aquifer (Cross Valley

Aquifer)." However, at page A-11 the analysis states that the location chosen for the spill is a location in which the aquifer is at a depth of more than 100 feet below low permeable soils. The analysis goes on to conclude that there is "an extremely low risk that the spill could have reached the Cross Valley Aquifer."

In contrast to these statements, the *Support Document for the EPA Designation of the Cross Valley Aquifer as a Sole Source Aquifer*, that is found in "Appendix B-2 - Water" of the Application, states as follows:

> <u>Potential for Contamination</u>
>
> Since water reaches this aquifer by downward percolation of the precipitation on the plateau surface, contamination from any surface source can enter the aquifer by the same route. Any material spilled or disposed of in unlined sites on the surface may migrate downward, under the hydrologic conditions prevalent in the area, until it reaches the ground water. Once the ground water becomes contaminated, its usefulness as a source of drinking water could be impaired or destroyed. Assuming that the technology to remove the contaminant, or contaminants, exists and is readily available, an increased expenditure of energy and funds could still be required to make the water useable again. If the technology is not available, or if the expense for decontamination is too high, the contaminated aquifer could become practically useless as a drinking water supply and its usefulness for other purposes could be greatly impaired.

The statements in the EPA document demonstrate that the hydrologic conditions prevalent in the area create a situation in which the Cross Valley Aquifer is subject to contamination from a spill by the proposed pipeline. If Scenario 1 was supposed to demonstrate "the potential issues associated with a spill over a sole source aquifer (Cross Valley Aquifer)", the spill should have been located such that the hydrologic conditions near the spill did not assure that there would be no impact on the aquifer from a spill. For example, at page 3.3-63 of the Application, Olympic admits that the proposed pipeline will cross 1,700 feet of the aquifer in which the soils beneath the pipeline are "well drained permeable soils that are directly underlain by portions of the aquifer." A spill along this section of the pipeline would not have low risk of impacting the aquifer, and thus this section of the pipeline would be a more appropriate section around which to design a spill scenario.

Further, the conclusion at the end of Scenario 1 that there is an extremely low risk that the spill at the location selected by Olympic could have affected the Cross Valley Aquifer (page A-11) is not supported by any detailed information. The analysis simply assumes that the contamination in the ground water will be remediated before it reaches the aquifer. This assumption may not be correct.

Finally, as I indicated above, the assumptions built into the scenario have limited the total amount spilled below what would be expected in this type of a spill scenario.

Q. Do you have any specific critiques concerning spill Scenario 2?

A. Yes. Scenario 2, as its described beginning at page A-12 of the Product Spill Analysis, was designed to "illustrate the potential impacts to groundwater and aquatic habitats." The scenario was designed such that the spill occurs at a location in which ground water is at depths below ten feet and the spill is discovered and cleaned up before the product goes below five feet into the soil. Thus, the scenario is designed to insure that ground water will not be impacted. A scenario that is supposed to show the potential impacts to ground water should not be designed such that ground water cannot be impacted. There clearly are locations along the route where a spill will impact ground water. Accordingly, Scenario 2 does not provide the decision-maker with any useful information concerning the actual risks posed by the proposed pipeline.

Also, as I've indicated above, assumptions built into the scenario have limited the total amount spilled far below what would be expected in this type of a spill scenario.

Q. Do you have any specific critiques concerning spill Scenario 3?

A. Yes. Scenario 3, as it is described beginning at page A-16 of the Product Spill Analysis, was designed to "illustrate the potential effects of a release in wetlands and other important aquatic habitats." The scenario does not provide any detail on how the spilled contamination actually impacted the wetlands. There is no analysis of the total amount of wetlands that were impacted, nor is there any analysis concerning how the product contamination may have impacted various functions of the wetlands that were impacted. The analysis simply assumes that the impacted wetlands are restored. There is no guarantee that impacted wetlands can be restored, or will naturally regenerate. Such assumptions are more appropriate to a "best case" scenario, and inappropriate to an impact analysis.

Finally, as I've indicated above, the assumptions built into the scenario have unrealistically limited the total amount spilled below that expected in this type of a spill.

Q. Do you have any specific critiques concerning spill Scenario 4?

A. Yes. Scenario 4, as it is described beginning on page A-19 of the Product Spill Analysis, was designed to assess "the effects of a spill in an recreation area with aquatic habitat." There is inadequate discussion about the long term impacts of the product spill to the aquatic habitat. The analysis states that natural recovery will have the least adverse impacts, but it does not indicate how that recovery process works, how long it takes, and whether there will be a full recovery. Since these scenarios contain Olympic's only discussion of spill impacts, these are fundamental questions concerning the severity of impact and potential for recovery, and require answers.

Finally, as indicated above, assumptions built into the scenario have severely limited the total amount spilled far below what would be expected in this type of a spill scenario.

Q. Do you have any specific critiques concerning spill Scenario 5?

A. Yes. Scenario 5, as described beginning on page A-22 of the Product Spill Analysis, was designed to "illustrate the effects of a release over a shallow aquifer and in aquatic environment." The scenario indicates that groundwater is impacted by the spill and states that a cleanup is instituted, but it simply ends by saying that the cleanup is periodically monitored to assess its progress. There is no indication of the severity of the contamination, expected length of cleanup, likelihood that cleanup will be successful, or potential risk of the contamination reaching the river.

Finally, as I've indicated above, the assumptions built into the scenario have limited the total amount spilled below that expected for this type of spill.

Q. Do you have any specific critiques concerning spill Scenario 6?

A. Yes. Scenario 6, as described beginning on page A-25 of the Product Spill Analysis, was designed to "demonstrate the effects of a winter release on a section of the pipeline difficult to access." The event is supposed to represent a short-term release, but the spill is a failure of valve seals rather than a complete break in the pipe. As such, the potential volume that could be released is extremely small compared a rupture of the pipe. It would seem more appropriate to evaluate a complete break in a remote situation, rather than designing the only remote leak situation to be one in which a major release could not happen. Moreover, no reason is given for not including a long term leak scenario at this location. A long term leak in this remote location could go undetected for a considerable time period. A leak less than 1 percent of flow could potentially go undetected in a remote location for months. It is also difficult to determine how spill volumes were calculated for this scenario. Based on the assumptions in Appendix B of the Product Spill Analysis, product is assumed to stop flowing in two hours, but in this scenario response personnel did not arrive at the site for six hours.

Also, as indicated above, assumptions built into the scenario limited the total spill below that expected in this type of spill.

Q. Do you have any specific critiques concerning spill Scenario 7?

A. Yes. Scenario 7 is described beginning on page A-28 of the Product Spill Analysis, and was designed to address "the effects of a release at a large surface water body, aquatic habitats and potential irrigation water quality impacts." Product from the release enters Keechelus Lake but does not enter the Yakima River. There is no explanation why the spill does not reach the Yakima River. Nor is there any discussion concerning whether the spill could reach the Yakima River under different circumstances. The Lake level at time of the spill is stated to be 15 feet below the high water line, but there is no explanation of how that affects the scenario. The wind is stated to be northwesterly at 10 to 15 miles per hour, but there is no explanation of how that fact impacts the scenario. It is unclear whether these factors could have been changed to create a situation in which a spill to the lake would likely be released into the Yakima River. Thus the actual threat the proposed pipeline may create for the Yakima River is not set forth in this scenario!

Finally, as indicated above, built-in assumptions limit the total spill below expectation for this type of spill.

Q. Do you have any specific critiques concerning spill Scenario 8?

A. Yes. Scenario 8, described beginning on page A-31 of the Product Spill Analysis, was designed to "illustrate the effects of a release on a river system that is heavily utilized for agricultural and recreational purposes and also supports an important fishery." The scenario states that the short-term spill would result in a major release of diesel fuel, but the total volume spilled is only 68,000 gallons. Short-term spills under these scenarios are supposed to assume a complete break in the pipe, per stated assumption on page 14. It is unlikely that only 68,000 gallons would be released from a complete rupture. The long-term spill scenario assumes the leak is discovered and repaired within 72 hours. Such a short duration does not represent a long-term spill.

The Scenario description states the spill occurs 25 miles west of Kittitas Terminal, at Milepost 94.5, location of block valve #14 on east side of Yakima River crossing. The Application (version of May 1998) identifies block valve #14 is for Stampede Station, and that block valve #17 is east side of Yakima River crossing, but at mile post 95.26. Our reckonings of the mileposts are that the actual Yakima River crossing is at MP 94.45, at an elevation of about 1,800 ft. The valve east of the River at Milepost 95.26, is at a local peak in pipeline elevation, at about 2,720 ft. The line peak to the west is at Milepost 86.9, South Cle Elum Ridge, at an elevation of 2,380 ft. If these facts are approximately correct, then the spill release site has been chosen to be at a local peak in pipeline elevation, to purposely limit the spill release. A release at the River itself would empty both sides of the pipe in the short term, at least from each high point, at least 326,000 gallons. Conflicting information about valve locations raises serious questions. Choosing spill points at pipeline peaks is not a credible attempt to "illustrate effects of a release on a river system…."

The scenario indicates that ground water has been contaminated by the diesel spill, but it does not indicate the extent of the contamination or the likelihood of a successful cleanup. The scenario simply states that a remediation system is installed and progress is monitored periodically.

The scenario indicates that the spill is located in an area that supports an important fishery but it does not discuss any impacts to fish. This omission is even more glaring when this scenario is compared to the barge spill scenarios in which fish are assumed to be in the location of the spill. If fish can be near a barge spill, they can also be near a pipeline spill to a major river like the Yakima. These type of differences indicate that the pipeline spill scenarios are "best case" scenarios while the barge spill scenarios are "worst case" scenarios.

Finally, as I've indicated above, the assumptions built into the scenario have limited the total amount spilled below what would be expected in this type of a spill scenario.

Q. Do you have any specific critiques concerning spill Scenario 9?

A. Yes. Scenario 9, as described beginning on page A-35 of the Product Spill Analysis, was designed to "illustrate the effects of a spill over a shallow aquifer and adjacent to an aquatic habitat." The scenario states that ground water is impacted and that a remediation system is installed, but there is no description concerning extent of the ground water problem and likelihood that the cleanup will be effective. The scenario simply states that the remedial action will be monitored for progress. This is an inadequate analysis and description of impacts.

Finally, as indicated above, the assumptions built into the scenario have limited the total amount spilled far below what would be expected in this type of a spill.

Q. Do you have any specific critiques concerning spill Scenario 10?

A. Yes. Scenario 10, as described beginning on page A-38 of the Product Spill Analysis, was designed to illustrate "effects of a slow release below a major river." The scenario acknowledges that a long-term spill at this location could go undetected for a considerable period of time, and it even acknowledges that the way the spill is detected is not likely possible. Even with those acknowledgments, the scenario still assumes that the spill is detected and responded to within 72 hours. This seems an inconsistent and incredible set of assumptions.

The scenario acknowledges that a leak under the Columbia River will impact sediments, but it does not discuss any potential impacts to fish. The scenario does not even discuss whether there are fish in the area.

The scenario simply states that the response would be restricted to evaluating the cause and repairing the pipeline. The scenario does not discuss how the pipeline leak that is under the Columbia River can be repaired, or what impacts would be created by the repair process. It is unlikely that the repair of a section of pipe under the Columbia River would be easy or without environmental impacts.

Finally, as indicated above, assumptions built into the scenario limit the total amount of spill well below that expected in this type of a spill scenario.

Q. Do you have any specific critiques concerning spill Scenario 11?

A. Yes. Scenario 11, described beginning at page A-40 of the Product Spill Analysis, was designed to illustrate "the effects of a spill into a sensitive wetland area and wildlife habitat." The scenario assumes discovery of the spill within 65 hours, a short time for a long-term spill. Because a small leak of only 65 hours was chosen only 11,700 gallons were released. The scenario does not include a short-term major release or a more realistic long-term release, and thus this scenario does not adequately evaluate the potential significant risk the pipeline would pose to this sensitive wetland.

A small hole or weld break, as postulated for this spill, of < 1 inch diameter, as mentioned on page 14 by Dames & Moore, let's say 1/4", can proceed at a respectable rate, easily at slightly less than one percent of flow, below the detectable threshold, one percent of flow. This would be about 892 gallons per hour. In 65 hours, a total of 58,000 gallons would accumulate. Diesel oil is not so easily detected, however, first because it is not as volatile as gasoline, for example, and second because it is quite clear visually. Sixty-five hour detection might be a best case detection, then.

It is also important to note that a rupture at this Crab Creek location, which is not discussed here, would result in a spill of about 427,000 gallons in the short term, since this is the amount contained between high points on either side. There are no valves placed from Milepost 165 to 178.53.

As indicated, the assumptions built into the scenario limit the total amount spilled below that normally expected in this type of a spill scenario. The scenario is more like a best case than a worst case, and does not serve the purpose of "illustrating effects of spill into a sensitive wetland," nor of demonstrating the realistic need for cleanup, remediation, additional preventive or protective measures.

Q. Do you have any specific critiques concerning spill Scenario 12?

A. Yes. Scenario 12, described beginning at page A-43 of the Product Spill Analysis, was designed to demonstrate disruption to agricultural operations, and adverse effects to wetlands. This short-term event, which would be a line rupture according to the page 14 description, is immediately detected. This is a best case assumption, since agricultural operations, by which the spill is apparently detected, are not ongoing 24 hours. Although the event would be noticed within minutes at the Control Center, location of the leak would probably require several hours, at times when field workers were not present. In this case, although the pumps might be shut down in a few minutes, valves would not be. Time would be required to locate the leak, and then send pipeline personnel to shut the valves; we must assume that any block valves are manual, since there is no specification that all mainline block valves will be remote operated. Four hours could easily go buy before the line is isolated. Since points to the north are at higher elevation, and the next block valve is at Othello Pump Station, at about 1,200 ft. elevation, whereas the spill location is at about elevation 840 ft., the line will continue to drain during this time. We estimate about 73,000 gallons will have escaped in that time.

What will stop the line from continuing to drain down then? We have not seen emergency plans that include plugging the hole in the line, so we must assume that line will continue to empty. Will the block valves at Othello P.S. stop the flow completely? Only if the block valves are hydrostatically tested periodically, say yearly, and follow-up maintenance is performed to prove their tightness. We have not seen any maintenance plans or promises of this type so far. Therefore, we must assume the line will continue to drain until it is empty. Cleanup operations will be delayed, and the fire hazard increased by the continuing drainage. The potential for groundwater contamination is probably much higher than inferred in the description.

As we see, assumptions built into the scenario as depicted by Dames & Moore severely limit the total spill to much less than could be expected. Much more effort should be expended to improve the value of this scenario, so that realistic impacts can be evaluated. Then consideration will need to be given the mitigation measures necessary to reduce these impacts, and to cleanup and restore the area and the groundwater, which would probably be impacted.

Q. What type of additional mitigation would you suggest for the pipeline design to protect against contamination of ground water or sole source aquifers?

A. I'll first suggest a short list of design features, practices, and measures that can provide protection in a wide variety of circumstances, and then indicate how to make choose the best protection.

Double-wall pipe or thicker pipe (say, 1/2" wall thickness) can provide a lot of protection from both corrosion and external damage. Double-wall pipe would require a monitoring system to ensure performance in practice. The greatest danger is from undetected leaks, since they might only be detected once the damage has occurred. The best protection from these is to perform ground survey monitoring periodically, say every two weeks, in the critical areas, using trained personnel with hydrocarbon probes. No single technique or equipment can provide the measure of protection needed, however; hydrostatic testing annually is the only true test of pipeline integrity, that assures no small leaks are present, and gives adequate backup to survey monitoring. Leak detection systems of different types may provide additional protection beyond that planned by Olympic in their SCADA system. For example, acoustic emission leak detection systems could be installed to protect a sole source aquifer. In certain cases, permanent diversionary berms and containment structures may be a necessary precaution.

Each area requiring protection should be carefully studied, both as to the likely consequences of "worst case" scenarios, likely sequences of events in such cases, and the specific vulnerabilities of the groundwater resources and sole source aquifers. Topography, soil permeability and erosion potential, soil corrosivity, specifics of the soil and rock substructure, planned pipeline backfill materials and methods, length of the vulnerable resource along the pipeline - all these and more must be considered. Combinations of protective measures can then be evaluated as to their likely effectiveness and reliability over the pipeline lifetime. Mastandrea provided some guidance concerning the effectiveness of different equipment and methods in his earlier work. We have summarized and updated his methodology in Appendix J of Ex. JWM-1.

The western section of the proposed Cross Cascade Pipe Line crosses the sole source Cross Valley Aquifer, Tolt River, many streams, and runs many miles along close to and crosses the Snoqualmie River. It also runs along the shore of Keechelus Lake, Lake Easton, and the Yakima River Valley for a long distance, and crosses the Ellensberg aquifer. The proposed pipeline moreover poses a threat to groundwater through large portions of this region. Comprehensive examination of the potential threat to groundwater in these areas should be undertaken and documented for agency review. Certain precautionary measures may be appropriate for this entire western segment of the line, because the extent of vulnerability is so great in length. In my opinion, this section should be 1/2" wall thickness, and should be hydrostatically tested annually. The pipe should be buried 4 ft. in lieu of the usual 3 ft., and the type and specification of pipeline trench backfill material, methods, and third-party construction monitoring for same, should be submitted for agency approval. The more vulnerable portions of this line (such as the Cross Valley Aquifer) should also be surveyed by ground patrol using hydrocarbon probes (flame ionization detector) every two weeks, and might be double-wall pipe. Some diversionary berm and containment structure should be provided in the locations where the pipeline is close to and upgradient of Keechelus Lake and Lake Easton. In addition, careful studies should be conducted to determine the most protective method for each stream and river crossing.

A similar strategy may also be appropriate in certain selected areas in eastern Washington where groundwater resources are considered vulnerable. This possibility should also receive careful study in the "comprehensive examination of potential threat…." referred to above.

Q. What type of additional mitigation would you suggest to protect against contamination of Lake Keechelus?

A. As mentioned briefly above, permanent diversionary berms that are properly graded to lead any spills to containment structures that are designed to provide protection from a reasonable size of spill, should be designed and submitted for approval. In addition, as suggested above for the entire western portion of Cross Cascade Pipe Line, double wall or 1/2" wall thickness pipe, hydrostatic testing annually, four ft. depth of cover, utilize preferred backfill materials and procedures, and conduct bi-weekly ground patrols using hydrocarbon probe. Similar protection should be provided especially vulnerable portions of the route adjacent the Yakima River valley, and Lake Easton.

Q. What general additional mitigation would you suggest in terms of the design and construction of the proposed pipeline?

A. Welds should be 100% radiographically tested, and the X-rays and inspection subjected to independent third-party review at the construction site. All mainline block valves should be remotely operated, fire safe, and doubly redundant in operation and communications. Valves should be placed in vaults, and designed and constructed so as to remain operational, by hand or remotely, in the event of flooding. All mainline block valves should be tested hydrostatically once a year, and follow-up maintenance performed to assure tight closure. Initial and annual hydrostatic line testing should be audited on site. Line should be fitted to allow direct measurement of testing fluid temperature and pressure at all valves. Prior to commencing actual test, the line pack should be proven by measurement of test medium bulk modulus. Computation of apparent line leak rate should be done in real-time, to establish that leak rate remained within acceptable criterion, such as that utilized by California State Fire Marshal regulations, for the entire test period. Data and satisfactory results should be certified in writing for agency approval. An independent third-party pipeline inspector should be under contract to the State to audit construction activities, pipeline safety and environmental mitigation measures, and assure that laws, regulations and applicable standards are followed. He should have stop-work authority.

Stream and river crossings shall be designed and constructed in accordance with plans derived from comprehensive site-specific studies of each crossing, performed in accordance with procedures and guidelines published in ANSI B31.4, 49 CFR, relevant OPS Bulletins shown in Appendix F of Ex. JWM-1, and the API 1105, and approved by submittal to the State. Plans and specifications submitted for stream and river crossings should include specification and procedure for backfill materials, including permeability and density.

I would suggest that the pipeline be routed over one of the bridges or the dam at the Columbia River, since the River itself is so vulnerable, and placement by directional drilling has unusual risks because of the fractured basalt substructure.

I would further suggest that the pipeline not be routed through the railroad tunnel at Snoqualmie, unless a vapor sensing alarm system, plus backup ventilation system, is installed therein.

Submitted plans shall include details of the cathodic protection system, including test stations for measuring pipe-to-soil potentials. An analysis of the feasibility of detecting corrosion along the line, given the specified separation of test stations at all points along the line, should be included.

Q. What addition mitigation would you suggest in terms of the long term operation of the proposed pipeline?

A. Assurance of integrity must be provided by a combination of reliable methods. First, the line should be monitored by properly trained ground survey crew with hydrocarbon detection equipment, weekly in populated, other sensitive, vulnerable, or high risk areas. These ground crews should use an appropriate mixture of driving and walking, so as to provide the most effective detailed coverage for the purpose of detecting small leaks and potential intrusion on the right-of-way that could pose a threat to pipeline integrity. This is the most reliable method for detecting smaller, and otherwise undetectable leaks.

Aerial inspection may be carried out weekly in rural areas, with a pilot and trained pipeline engineer. Videocameras should be used to photograph the right-of-way continuously, and these videos carefully reviewed after the fact. The value of aerial inspection has not really been proven. It is difficult, if not impossible, to see a pipeline leak from the air. The distance is too great, the plane's motion is quite fast, the pollutant petroleum products are clear, and rarely are there significant observable effects on foliage. It is possible to equip planes with sophisticated sensing equipment for detection of pollution on the ground or in the water. The U.S. Coast Guard had a few such planes equipped. A few other countries have a small fleet of such "aerial pollution survey" planes. In addition to the aerial surveys, ground survey crews should monitor rural parts of the right-of-way on a less frequent basis. Ground survey crews can use hydrocarbon detection equipment, and may be able to detect spills by smell. Moreover, ground crews can more easily investigate any signs of concern.

A modern leak detection system, based on remote measurement and analysis of pressures, flow rates, and temperatures of product in the line at all pump stations and mainline block valves, should be installed and operational 100 percent of the operating time. The designed leak detection sensitivity, the probability of detection P_d, and the probability of false alarms P_{fa}, should all be included in reports that are part of the Application and a part of certification of the line prior to operation. The system should be tested to these standards, using an independent third-party contractor to certify results. The fittings for fluid temperature measurement, installed for hydrostatic testing purposes at each mainline block valve, as described above, would be used to introduce test leaks at times, flow rates, and locations unknown to the pipeline operator, to provide adequate test and proper certification of results. This is essentially the methodology currently used to certify precision leak testing for underground storage tanks (USTs). The system should be retested and re-certified annually. Copies of each certification should be filed with the State. There are several other types of leak detection/monitoring systems available. For example, acoustic emission monitoring systems can be designed and installed to monitor a pipeline for shorter distances, such as near a sensitive resource like a sole-source aquifer. Very small leaks can be detected and located by means of the acoustic leak signature they transmit through the pipe itself.

Emergency response plans should detail the equipment, training, and the personnel who will be staged to respond to particular segments of the line. This level of planning should be included as a submittal to the State, for environmental approval. The staging should be based on a well-documented systems and logistics analysis, proving responsiveness to shutdown the pipeline, locate the leak, isolate the leak using mainline block valves, plug the leak, control the oil, provide fire protection, and conduct cleanup and restoration operations in accordance with all federal and State requirements. Emergency response plans must conform to requirements of the Oil Pollution Act of 1990, which includes requirement to respond to the threat of a spill, such as may be present during flooding, fires, and storms.

Q. What is the value of hydrostatic testing, above and beyond detection of pipe wall defects using smart pigs?

A. Most smart pigs can detect changes in magnetic flux linkage (MFL) to the steel pipe walls. Their basic capability is therefore to detect areas of pipe wall thinning, such as results from either external or internal corrosion. Second-generation high-resolution in-line inspection tools (ILIT) can detect smaller flaws. The new high-resolution British Gas tool is being marketed in this country by Pipeline Integrity International. Cracks resulting from stress-corrosion cracking (SCC) have been reliably detected in recent years. This British Gas technology high-resolution smart pig, or its equivalent capability, should be used annually. At the present time, no known equivalent technology is known. British Gas also markets an elastic wave inspection tool that operates at ultrasonic frequencies. This alternative might be used on occasion. There is a limit in smallness of size, both in depth and radial extent (or length and width), for detection of flaws or deficiencies in the pipe walls, using smart pigs. The limits vary with the tool, and the computer analysis of results. The tools cannot detect all flaws or defects that may leak. Therefore, smart pigs cannot be relied upon to measure or assure pipeline integrity.

Hydrostatic testing is the only nondestructive testing method capable of detecting small leaks. We have noted that the leak monitoring systems in operational use, such as SCADA-based systems that are used by Olympic Pipeline Co., Colonial Pipeline Co., and Williams Pipeline Co., have limited ability to detect small leaks. The limit might be at or slightly below one percent of the flow rate, which is actually not a very small leak. For the Thrasher-Kittitas section from years 6 through 15, the flow rate is about 103,000 barrels per day. One percent of this flow rate, the upper limit for detection of a slow leak, would be about 1,800 gallons per hour! This amount of fluid can discharge through a small hole at the planned operating pressures. Thus, the only positive test of pipeline integrity available is hydrostatic testing. At the present time, undetected leaks are a major problem for petroleum pipeline systems, because the best detection methods for smaller spills are not generally practiced. Few companies use line walkers with hydrocarbon probes routinely; few require that their leak detection system be tested and certified stringently; and few conduct regular hydrostatic tests. An undetectable leak of just less than 1,800 gallon-per-hour may accumulate to 300,000 gallons in one to two weeks.

Hydrostatic testing must be performed to a rigid standard in order to achieve high levels of precision and reliability. The leak rate must be determined to be zero, within a very small range of error. A simple, short pressure test of a large pipeline will only verify that there is not gross leakage. The hydrostatic test method relies upon computing the volume of fluid contained in a known length of the pipe, at short intervals over a reasonably long length of time, based on measurements of pressure and temperature. There are some requirements to make this feasible. First, the two ends of the test must be tight. This usually means that a blind flange must be installed at both ends of the test, since large block valves rarely hold tight enough for such a test. The line pack must be 100 percent, which means that there may not be any air or vapor bubbles or pockets. There are procedures to achieve this, but in the final analysis, line pack must be verified by determining compressibility of the test medium experimentally. Presence of bubbles or pockets results in an erroneous value.

The line temperature must be stable, and not be influenced by the diurnal cycle, such as by sunlight playing on an aboveground portion of the line. The line temperature must be well characterized by accurate temperature measurements of the test fluid itself. The pressure must be measured accurately, and the pressure measurement device must be calibrated properly. Other requirements are contained in the regulations. California State Fire Marshal regulations set a somewhat higher standard than the federal rules in 49 CFR. Leak rates should be computed from measurements in real time, to be assured of meeting the requirement that the line not show a leak for four hours of measurement. If temperatures vary a small amount, the computed leak rate may not be within the prescribed tolerance, and the test may be invalid.

Thus, accuracy and value of the hydrostatic test depends upon the integrity of the test itself, and therefore on the integrity of the tester as well. Certification on site by an independently contracted third-party is one way to assure integrity of the test and certification.

Q. Has Olympic Pipeline adequately addressed the issue of decommissioning of the Cross Cascade Pipeline?

A. No. A plan for decommissioning, cleaning, and removal of the pipeline from the ground should be included in the Application, and in the Environmental Impact Statement. It is unsafe, and bad engineering practice, to allow used engineering facilities to clutter the underground. The general practice of using a scraper pig and water rinse, followed by nitrogen fill, is inadequate and does not prevent many potential long-term problems. The nitrogen fill does not last long, and residual oil on the pipe wall can vaporize, leaving the pipe with petroleum vapors as a potential time bomb, which could lead to a Guadalajara-type of disaster. If the pipe were to be temporarily left in the ground, a much better cleaning procedure should be specified. It is possible in some cases to find a new use for the old pipeline. Without such a new use, and without an active cathodic protection program, the line will rust, become holed, and present problems in the future. The line should be removed.

When a petroleum pipeline is decommissioned, or removed, an important issue is the cleanliness of the earth surrounding and underneath the line. There should be a comprehensive contamination investigation of the surrounding fill, when the line is excavated for removal. All soil found to be contaminated must undergo a thorough cleanup. Liability for the cleanup activities remains with the pipeline operator. It is important that the liability for both the pipeline removal and contamination cleanup operations be financially settled at the beginning of the pipeline project, as part of the environmental approval process.